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(54) Normally closed duckbill valve assembly

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GB-A- 2 085 732
GB-A- 2 094 443

(73) Proprietor: **VERNAY LABORATORIES, INC.**
120 East South College Street
Yellow Springs,
Ohio 45387-0310 (US)

(72) Inventor: **Atkinson, Gordon E.**
4316 Cortsville Road
Cedarville,
Ohio 45314 (US)
Inventor: **Bailey, James C.**
304 West South College Street
Yellow Springs,
Ohio 45387 (US)

(74) Representative: **Warren, Keith Stanley et al**
BARON & WARREN
18 South End
Kensington
London W8 5BU (GB)

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Description

The present invention relates generally to flow regulation apparatus, and more particularly, to a valve assembly adapted to permit substantially free flow through the valve in a first direction, while preventing flow through the valve in a second, opposite direction. Even more particularly, the present invention relates to valves commonly known as the "duckbill" type.

Duckbill valves are well known and are typically in the form of a resilient flow regulator member mounted in a fluid flow path and which has as its primary operative components a pair of lips arranged in a converging relationship from an inlet end at the base of the lips to an outlet end. At the outlet end of the regulator, the lips are located adjacent to each other so as to define a slit therebetween. The duckbill regulator is often mounted within a housing in a sealed relationship so that flow through the housing must pass through the regulator as well. In a first or forward direction, flow passes into the regulator through the inlet end, moving toward the slit formed at the outlet end. The flow pressure against the resilient lips opens the slit, allowing the flow to pass out of the regulator. When flow enters the duckbill regulator from a second or a reverse direction, the flow contacts the regulator lips at its outlet end, with the flow pressure against the resilient lips holding the slit in a closed position, thereby preventing flow through the valve.

In DE-A-1 611 944 which disclosure forms the bass for the preamble of independent claim 1, a tube closure having a duckbill type valve is disclosed and which comprises an insert made of elastic material. The insert is fitted into a tube and has a longitudinal slot as an outlet opening. The slot opens when the tube is squeezed and closes when the pressure is removed. The slot extends through the cylindrical body of the insert and may have incisions or notches on either side of the slot which provide additional elasticity and ensure effective opening and closing of the slot.

An administering set is disclosed in GB-A-2085732 which utilises a check valve at an inlet of a burette. The valve allows fluid flow only in a direction of an injection site from a drip chamber. The valve comprises a duckbill valve having a generally cylindrical upper portion and a pair of duckbill lips which angle inwardly and downwardly to meet and form a normally closed valve. Fluid flow in a downward direction will open the lips while upward fluid flow will be prevented by the check valve.

One of the requirements for one-way flow valves is that the valves must offer little resistance to fluid flow in one direction but will completely stop fluid flow in the opposite direction. Many prior art duckbill valves which are designed to firmly bias the valve lips together in order to completely prevent back flow will not fully open at low inlet pressures. Other duckbill valves which offer little resistance in forward flow conditions have a tendency to leak slightly during low back pressure conditions.

Another desirable characteristic of such valves in certain operating conditions is the ability to control the forward flow pressure at which the valve will open without significantly increasing the pressure drop through the valve. Prior art attempts to provide such valves have included providing reinforcing members around the resilient lips of the regulator, however, these prior art valve modifications have typically been accompanied with large pressure drops as the fluid passes through the valve.

Accordingly, a need exists for a valve assembly allowing fluid flow in a first direction and preventing fluid flow in a second, opposite direction in which virtually all leaks in the back flow direction are prevented, and in which means are provided for controlling the pressure at which forward flow may be initiated without restricting the flow path through the valve and creating a higher pressure drop between the inlet and outlet ends of the valve.

The present invention consists in a one-way duckbill check valve for use in a flow path for permitting free flow in said flow path in a first direction from a first to a second end of said valve and for preventing flow in said path in a second opposite direction, said valve comprising a valve body having a central longitudinal axis, an outer wall and a pair of valve lips positioned at said second end of the valve, said valve body and lips being formed of an elastomeric material and said lips defining an elongated normally closed outlet opening of said valve at said second end, characterised by a pair of planar inner surfaces extending in converging relationship to said second end, a pair of planar outer surfaces extending in converging relationship to said second end and located in substantially parallel relation to said inner surfaces such that said inner and outer surfaces define a pair of converging lips and means forming a pivot connection between said outer wall and said lips including a pair of connecting walls located on either side of said outlet opening and extending inwardly from said outer wall to intersect said outer surfaces of said lips along edges which curve concavely within respective planes defined by said outer surfaces.

The valve body may be provided with a pair of ribs located on diametrically opposite sides and extending parallel to the axis of the regulator in a plane containing the axis and oriented perpendicu-

lar to the outlet opening. The ribs engage the interior surface of a housing such that the main body is biased inwardly and the lips are caused to be pressed inwardly to close the outlet opening whereby the pressure required to initiate flow in the first direction may be precisely controlled. Thus, a positive biasing force is applied to the lips without restricting the movement of the valve lips as is the case where reinforcing members are applied directly to the valve lips.

In an alternative embodiment of the present invention, the rib members may be replaced with thickened portions of the main body wall such that the main body has a generally oval shape. In this embodiment, the thickened portions of the main body wall act in the same manner as the ribs and contact the interior surface of the housing to bias the lips together.

In a third embodiment of the invention, the outer surface of the main body may be formed with a circular shape and without ribs and the housing may be provided with ribs or raised portions for engaging the main body to bias the lips together.

In order that the present invention may be more readily understood, reference will now be made to the accompanying drawings, in which:-

Fig. 1 is an exploded perspective view of the duckbill valve assembly of the present invention;

Fig. 2 is a plan view of the outlet end of the regulator portion of the present invention;

Fig. 3 is a sectional view taken along line 3--3 of Fig. 2;

Fig. 4 is a sectional view taken along line 4--4 of Fig. 2;

Fig. 5 is a sectional view showing the assembled duckbill valve assembly of the present invention;

Fig. 6 is a plan view similar to Fig. 2 and showing an alternative embodiment of the regulator portion of the duckbill valve; and

Fig. 7 is an exploded perspective view showing a third embodiment of the present invention.

The valve assembly of the present invention is best seen by reference to Figs. 1 and 5. The valve assembly comprises a housing inlet portion 10, a housing outlet portion 12 and a regulator portion 14 which is located within the outlet portion 12. The portions 10 and 12 are preferably molded from a transparent acrylic plastic material, although other materials could also be used, depending upon the particular application for the valve assembly. Further, the flow regulator portion 14 is preferably molded as a single piece from a material having elastic properties such as an elastomeric material.

The flow regulator 14 of the preferred embodiment includes a main body 16 which is preferably cylindrical and which defines a central longitudinal axis 18 of the valve. The regulator portion 14 is formed as a hollow member to define a flow path from an inlet end 20 to an outlet end 22 of the regulator portion 14. The regulator portion 14 further includes a pair of substantially planar inner walls 24, 26, as may be seen in Figs. 3 and 4, which are arranged in converging relationship and extend through the interior of the main body 16 from the inlet end 20 to the outlet end 22. At the outlet end 22 the inner walls 24, 26 are disposed adjacent to each other to define a normally closed elongated slit 28 therebetween which is bisected by the axis 18. The inner walls are interconnected along the length of the main body 16 by a pair of curved side wall portions 30, 32 extending along the main body 14.

A pair of planar outer walls 34, 36 are disposed substantially parallel to the converging inner walls 24, 26 and extend in diverging relationship toward the inlet end 20 of the regulator portion 14 from a point adjacent to the slit 28 at the outlet end 22. The inner and outer walls together define a pair of lips 38, 40 which converge from the inlet to the outlet end of the valve regulator portion 14.

A pair of connecting walls 42, 44 having concave surfaces are located on either side of the slit 28 and extend from the main body 16 to intersect the lips 38, 40 at a point intermediate the inlet and outlet ends 20, 22 of the regulator portion 14. The intersection of the connecting walls 42, 44 with the lips 38, 40 forms a pivot portion for each of the lips 38, 40 to pivot away from each other so as to allow a fluid flow through the regulator portion 14 in a first direction from the inlet to the outlet end. In addition, the connecting walls 42, 44 and lips 38, 40 define a pair of cavities which extend into the main body from the outlet end 22 on either side of the slit 28.

As may be seen in Figs. 2 and 3, the connecting walls 42, 44 are each defined by a locus of points which are substantially equidistant from a predetermined center of curvature located along the central axis 18 whereby the intersection of the connecting walls 42, 44 with the lips 38, 40 define a pair of substantially semi-circular intersection lines 46, 48, as viewed in a direction perpendicular to planes containing the lips 38, 40, respectively. Thus, the lips 38, 40 are formed with a substantially semi-circular shape and are substantially biased into a closed position and supported for pivotal movement along the semi-circular lines 46, 48.

Referring to Fig. 5, the regulator portion 14 is further provided with a flange 50 extending radially outwardly beyond an outer wall 52 defining an outer circumferential extent of the main body 16. The outlet portion 12 of the housing is provided with a collar 54 supported by a shelf 56 extending around the periphery of the outlet portion 12. The shelf 56 and collar 54 define an annular seat for

receiving the flange 50 whereby the regulator portion 14 may be accurately positioned within the outlet portion 12. When the flange is in place on the valve seat of the outlet portion 12, the outer wall 52 of the main body 16, which extends substantially parallel to the axis 18 and which defines an axial extent of the main body 16, is held in spaced relation to the interior surface 58 of the outlet portion 12 and the outlet end 22 is held adjacent to an outlet port 60.

The inlet portion 10 includes a substantially circular cover plate 62 through which an inlet port 64 extends for allowing passage of fluid flow to the regulator portion 14. A circular sealing ring 66 extends perpendicularly from the cover plate 62. As may be seen in Fig. 5, the cover plate 62 engages a surface of the flange 50 whereby the flange is pressed onto the shelf surface 56 and the sealing ring 66 engages an outer surface of the collar 54 to thereby form a seal whereby fluid flow is forced to flow through the inlet port 64, through the inlet end 20 of the regulator 14 and through the slit 28 to the outlet port 60.

In order to provide a biasing force whereby the lips 38, 40 are forced together into a closed position, the main body 16 is provided with a pair of ribs 68, 70 which protrude radially from the outer wall 52 of the main body 16. The ribs 68, 70 extend parallel to the axis 18 in a plane containing the axis 18 and oriented perpendicular to the slit 28. The diameter of the outer wall 52 and the dimensions of the ribs 68, 70 are selected such that the ribs 68, 70 will engage the interior surface 58 of the outlet portion 12 in an interference fit whereby the main body is biased inwardly at the location of the ribs 68, 70. As a result of the biasing force applied to the main body 16, the connecting walls 42, 44 are caused to move inwardly toward each other whereby a greater spring force is produced along the semi-circular lines 46, 48 to positively bias the lips 38, 40 together without restricting their pivotal movement.

It should be apparent that by forming the ribs 68, 70 such that they extend an appropriate radial distance from the outer wall 52 of the main body 16, the amount of biasing force applied to the lips 38, 40 and therefore the amount of forward flow pressure required to initiate flow through the lips may be precisely controlled. In addition, the radius of curvature of the concave surfaces forming the connecting walls 42, 44 may also be varied to alter the amount of biasing force applied to the lips 38, 40 as the outer wall 52 of the main body 16 is biased inwardly.

It should be noted that the present invention is not limited to the particular rib structure shown for biasing the outer wall 52 inwardly and the biasing means may take alternative forms. For example, as may be seen in Fig. 6 in which like reference numerals are applied to like parts, the main body 16 is provided with enlarged portions formed by an increase in thickness of the outer wall 52, as indicated at 72 and 74. Thus, the outer wall 52 of the valve shown in Fig. 6 is formed as a slightly oval shape wherein the portion of the oval located on the major axis thereof contacts the interior surface 58 of the outlet portion 12 to bias the lips 38, 40 together.

In a third embodiment of the present invention, as may be seen in Fig. 7 and in which like reference numerals are applied to like parts, the interior surface 58 of the outlet portion 12 is formed as a cylindrical surface with radially inwardly extending protrusions which are depicted by ribs 76, 78. The regulator 14 of this embodiment is formed without ribs on the outer wall 52 of the main body 16, and the ribs 76, 78 act in the same manner as the ribs 68, 70 of the first embodiment to bias the wall 52 of the main body 16 inwardly.

The structure of the present invention provides an advantage over conventional prior art duckbill valves in that the lip portions 38, 40 of the valve are provided with a biasing portion formed adjacent to the semi-circular lines 46, 48 and which are located relatively close to the outlet slit 28 to provide a positive biasing force to the lips 38, 40 while also including the flexible lip portions 38, 40 which allow unrestricted flow through the outlet 22 of the regulator 14. In addition, by providing the cavities on either side of the slit 28, back pressure resulting from a reverse flow condition will act on the outer surfaces 34, 36 of the lips 38, 40 to further force the lips 38, 40 together and thereby prevent reverse flow through the valve.

In a preferred construction of the present invention, the relative dimensions of the interior surface 58 of the housing outlet portion 12 and the main body 16 may be selected such that a predetermined inward biasing force is produced on the lips 38, 40 whereby a predetermined forward flow pressure is required in order to initiate flow in the first direction from the inlet 20 to the outlet 22. In such a construction, once the forward flow has been initiated, the flow will continue in an unrestricted manner until the pressure drops below the predetermined level at which time the valve lips will shut, even in the absence of reverse fluid flow. Thus, the valve of the present invention is not dependent upon reverse flow pressure to bias the lips 38, 40 together to close the slit 28 for preventing reverse flow.

Claims

1. A one-way duckbill check valve (14) for use in a flow path for permitting free flow in said flow

path in a first direction from a first (20) to a second end (22) of said valve (14) and for preventing flow in said path in a second opposite direction, said valve (14) comprising a valve body (16) having a central longitudinal axis (18), an outer wall (52) and a pair of valve lips (38, 40) positioned at said second end of the valve, said valve body (16) and lips (38, 40) being formed of an elastomeric material and said lips (38, 40) defining an elongated normally closed outlet opening (28) of said valve (14) at said second end (22), characterised by a pair of planar inner surfaces (24, 26) extending in converging relationship to said second end (22), a pair of planar outer surfaces (34, 36) extending in converging relationship to said second end (22) and located in substantially parallel relation to said inner surfaces (24, 26) such that said inner and outer surfaces define a pair of converging lips (38, 40), and means forming a pivot connection between said outer wall (52) and said lips (38, 40) including a pair of connecting walls (42, 44) located on either side of said outlet opening (28) and extending inwardly from said outer wall (52) to intersect said outer surfaces (34, 36) of said lips (38, 40) along edges which curve concavely within respective planes defined by said outer surfaces (34, 36).

2. The valve of claim 1, wherein the intersection of said connecting walls (42, 44) with said lips (38, 40) forms a pivot for each of said lips (38, 40) to pivot away from said axis (18) to allow flow in said first direction.

3. The valve of claim 1 or 2, wherein said elongated outlet opening (28) intersects said axis (18), and said connecting walls (42, 44) intersect said lips (38, 40) along a locus of points substantially equidistant from a predetermined center of curvature and located in said planes defined by said outer surfaces (34, 36).

4. The valve of claim 3, wherein said connecting walls (42, 44) are formed with concave surfaces and said concave surfaces are defined by a locus of points substantially equidistant from said predetermined center of curvature.

5. The valve of any preceding claim, including means for biasing said outer wall (52) inwardly whereby said pivot connection transmits a force to bias said lips (38, 40) together.

6. The valve of claim 5, wherein said biasing means includes enlarged portions (68, 70, 72, 74) located on opposite sides of said outer wall (52) and extending parallel to the axis (18) in a plane which contains the axis and is orientated perpendicular to said outlet opening (28).

7. The valve of claim 6, wherein said enlarged portions (68, 70) comprise a pair of diametrically opposite ribs.

8. The valve of claim 6, wherein said enlarged portions (72, 74) comprise an increase in the thickness of said outer wall (52) on opposite sides of said valve (14) such that the periphery of said outer wall (52) defines an oval shape.

9. The valve of any preceding claim, including a housing (10, 12) in which said valve body (16) is located.

10. The valve of claim 5 and 9, wherein said housing (10, 12) includes an inner wall (58) and said biasing means includes a pair of opposed raised portions (68, 70) located on said inner wall (58) for contacting and forcing said outer wall (52) inwardly.

11. The valve of claim 9 as appendent to claim 6, 7 or 8, wherein said housing (10, 12) includes an inner wall (58) and said enlarged portions contact and are biased inwardly by said inner wall (58).

Patentansprüche

1. Einweg-Rückschlagventil mit Löffel- bzw. Entenschnabelklappen (14) für die Verwendung in einem Strömungsweg, um einen freien Durchfluß in dem Strömungsweg in einer ersten Richtung von einem ersten (20) zu einem zweiten Ende (22) des Ventiles (14) zu erlauben, und um eine Strömung in dem Weg in einer zweiten entgegengesetzten Richtung zu verhindern, wobei das Ventil (14) einen Ventilkorpus (16) aufweist, der eine zentrale Längsachse (18) hat, eine äußere Wand (52) und ein Paar von Ventillippen (38, 40) bzw. -klappen aufweist, die an dem zweiten Ende des Ventils angeordnet sind, wobei der Ventilkorpus (16) und die Lippen bzw. Klappen (38, 40) aus einem elastomeren Material gebildet sind und die Klappen (38, 40) eine längliche, normalerweise geschlossene Auslaßöffnung (28) des Ventils (14) an dem zweiten Ende (22) definieren, **gekennzeichnet durch** ein Paar von ebenen inneren Oberflächen (24, 26), die sich konvergierend in Richtung des zweiten Endes (22) erstrecken, ein Paar von ebenen äußeren Oberflächen (34, 36), die sich konvergierend zu dem zweiten Ende (22) erstrecken und die

im wesentlichen parallel zu den inneren Oberflächen (24, 26) angeordnet sind, so daß die inneren und äußeren Oberflächen ein Paar von konvergierenden Lippen bzw. Klappen (38, 40) definieren, und Einrichtungen, die eine Schwenkverbindung zwischen der äußeren Wand (52) und den Lippen (38, 40) bilden, einschließlich eines Paars von Verbindungswänden (42, 44), die auf jeder Seite der Auslaßöffnung (28) angeordnet sind und sich von der Außenwand (52) einwärts erstrecken, so daß sie die Außenflächen (34, 36) der Lippen (38, 40) entlang von Kanten schneiden, die konkav gekrümmt innerhalb der jeweiligen Ebene verlaufen, die durch die äußeren Oberflächen (34, 36) definiert werden.

2. Ventil nach Anspruch 1, wobei der Schnitt der Verbindungswände (42, 44) mit den Klappen (38, 40) eine Schwenkverbindung für jede der Klappen (38, 40) bildet, so daß sie von der Achse (18) weg schwenken, um eine Strömung in der ersten Richtung zu ermöglichen.

3. Ventil nach Anspruch 1 oder 2, wobei die längliche Auslaßöffnung (28) die Achse (18) schneidet, und wobei die Verbindungswände (42, 44) die Klappen (38, 40) entlang einer Position von Punkten schneiden, die im wesentlichen in gleichen Abständen von einem vorbestimmten Krümmungszentrum liegen und in den Ebenen angeordnet sind, die von den äußeren Oberflächen (34, 36) definiert werden..

4. Ventil nach Anspruch 3, wobei die Verbindungswände (42, 44) mit konkaven Flächen ausgebildet sind, und wobei die konkaven Flächen durch eine Position von Punkten definiert sind, die im wesentlichen in gleichen Abständen von dem vorbestimmten Krümmungszentrum liegen.

5. Ventil nach einem der vorstehenden Ansprüche, einschließlich einer Einrichtung zum Vorspannen der äußeren Wand (52) nach innen, wodurch die Schwenkverbindung eine Kraft überträgt, um die Klappen (38, 40) zusammen vorzuspannen.

6. Ventil nach Anspruch 5, wobei die Vorspanneinrichtung vergrößerte Abschnitte (68, 70) aufweist, die auf gegenüberliegenden Seiten der äußeren Wand (52) angeordnet sind und sich parallel zu der Achse (18) in einer Ebene erstrecken, welche die Achse enthält und senkrecht zu der Auslaßöffnung (28) ausgerichtet ist.

7. Ventil nach Anspruch 6, wobei die vergrößerten Abschnitte (68, 70) ein Paar von diametral gegenüberliegenden Rippen aufweist.

8. Ventil nach Anspruch 6, wobei die vergrößerten Abschnitte (72, 74) eine zunehmend dickere äußere Wand (52) auf gegenüberliegenden Seiten des Ventils (14) aufweisen, so daß der Umfang der äußeren Wand (52) eine ovale Form festlegt bzw. definiert.

9. Ventil nach einem der vorstehenden Ansprüche, einschließlich eines Gehäuses (10, 12), in welchem der Ventilkorpus (16) angeordnet ist.

10. Ventil nach Anspruch 5 und 9, wobei das Gehäuse (10, 12) eine innere Wand (58) aufweist und wobei die Vorspanneinrichtung ein Paar von gegenüberliegenden, erhabenen Abschnitten (68, 70) aufweist, die auf der inneren Wand (58) angeordnet sind, um mit der äußeren Wand (52) in Kontakt treten und diese nach innen zu drücken.

11. Ventil nach Anspruch 9, so weit er sich auf die Ansprüche 6, 7 oder 8 bezieht, wobei das Gehäuse (10, 12) eine innere Wand aufweist und wobei die vergrößerten Abschnitte (68, 70) mit der inneren Wand (58) in Kontakt sind und von dieser nach innen vorgespannt werden.

Revendications

1. Soupape de retenue unidirectionnelle à bec de canard (14) destinée à être utilisée dans un circuit d'écoulement pour permettre l'écoulement libre dans ledit circuit d'écoulement dans un premier sens, d'une première (20) à une seconde extrémité (22) de ladite soupape (14) et pour empêcher l'écoulement dans ledit circuit dans un second sens opposé, ladite soupape (14) comprenant un corps (16) de soupape ayant un axe longitudinal central (18), une paroi extérieure (52) et deux lèvres de soupape (38, 40) placées à ladite seconde extrémité de la soupape, ledit corps de soupape (16) et lesdites lèvres (38, 40) étant réalisés en une matière élastomère et lesdites lèvres (38, 40) délimitant une ouverture allongée de sortie (28) normalement fermée de ladite soupape (14) à ladite seconde extrémité (22), caractérisée par deux surfaces planes intérieures (24, 26) orientées en relation de convergence vers ladite seconde extrémité (22), deux surfaces planes extérieures (34, 36) orientées en relation de convergence vers ladite seconde extrémité (22) et placées en relation sensiblement de parallélisme avec lesdites surfaces intérieures

(24, 26) de façon que lesdites surfaces intérieures et extérieures délimitent deux lèvres convergentes (38, 40), ainsi que des moyens formant une liaison à pivotement entre ladite paroi extérieure (52) et lesdites lèvres (38, 40) et comprenant deux parois de liaison (42, 44) placées sur chacun des côtés de ladite ouverture de sortie (28) et orientées vers l'intérieur de ladite paroi extérieure (52) de manière à intersecter lesdites surfaces extérieures (34, 36) desdites lèvres (38, 40) le long de bords qui présentent une courbe concave à l'intérieur de plans respectifs définis par lesdites surfaces extérieures (34, 36).

2. Soupape selon la revendication 1, dans laquelle l'intersection desdites parois de liaison (42, 44) et desdites lèvres (38, 40) forme un pivot pour chacune desdites lèvres (38, 40) afin qu'elles pivotent en s'éloignant dudit axe (18) pour permettre l'écoulement dans ledit premier sens.

3. Soupape selon la revendication 1 ou 2, dans laquelle ladite ouverture allongée de sortie (28) intersecte ledit axe (18) et lesdites parois de liaison (42, 44) intersectent lesdites lèvres (38, 40) le long d'un lieu de points sensiblement équidistants d'un centre prédéterminé de courbure et placés dans lesdits plans formés par lesdites surfaces extérieures (34, 36).

4. Soupape selon la revendication 3, dans laquelle lesdites parois de liaison (42, 44) présentent des surfaces concaves et lesdites surfaces concaves sont définies par un lieu de points sensiblement équidistants dudit centre prédéterminé de courbure.

5. Soupape selon l'une quelconque des revendications précédentes, comprenant des moyens pour repousser ladite paroi extérieure (52) vers l'intérieur de manière que ladite liaison à pivotement transmette une force qui repousse lesdites lèvres (38, 40) l'une contre l'autre.

6. Soupape selon la revendication 5, dans laquelle lesdits moyens de poussée comprennent des parties élargies (68, 70, 72, 74) placées sur des côtés opposés de ladite paroi extérieure (52) et orientées parallèlement à l'axe (18) dans un plan qui passe par l'axe et qui est perpendiculaire à ladite ouverture de sortie (28).

7. Soupape selon la revendication 6, dans laquelle lesdites parties élargies (68, 70) consistent en deux nervures diamétralement opposées.

8. Soupape selon la revendication 6, dans laquelle lesdites parties élargies (72, 74) consistent en une surépaisseur de ladite paroi extérieure (52) sur des côtés opposés de ladite soupape (14) de façon que la périphérie de ladite paroi extérieure (52) présente une forme ovale.

9. Soupape selon l'une quelconque des revendications précédentes, comprenant une cage (10, 12) dans laquelle ledit corps de soupape (16) est placé.

10. Soupape selon les revendications 5 et 9, dans laquelle ladite cage (10, 12) comprend une paroi intérieure (58) et ledit moyen de poussée comprend deux parties opposées en relief (68, 70) placées sur ladite paroi intérieure (58) et destinées à entrer en contact avec, et à repousser, ladite paroi extérieure (52) vers l'intérieur.

11. Soupape selon la revendication 9 rattachée à la revendication 6, 7 ou 8, dans laquelle ladite cage (10, 12) comprend une paroi intérieure (58) et lesdites parties élargies sont en contact avec, et sont repoussées vers l'intérieur par, ladite paroi intérieure (58).

FIG - 1

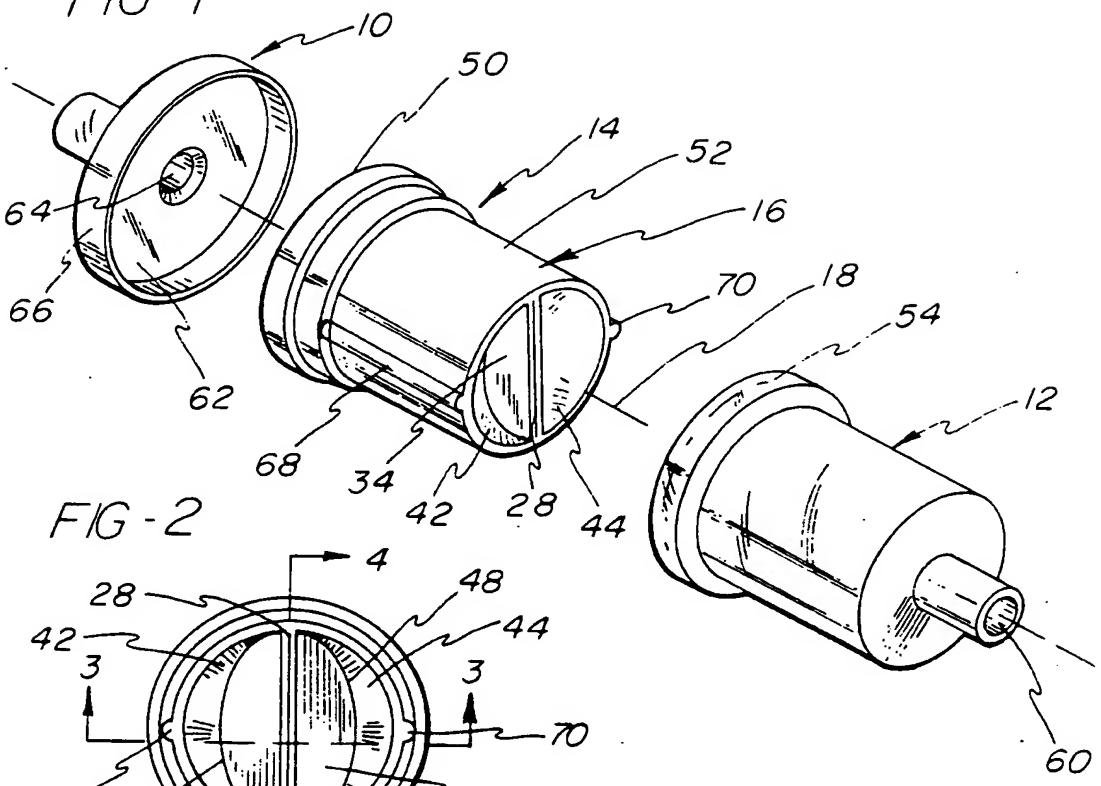


FIG - 2

FIG - 3

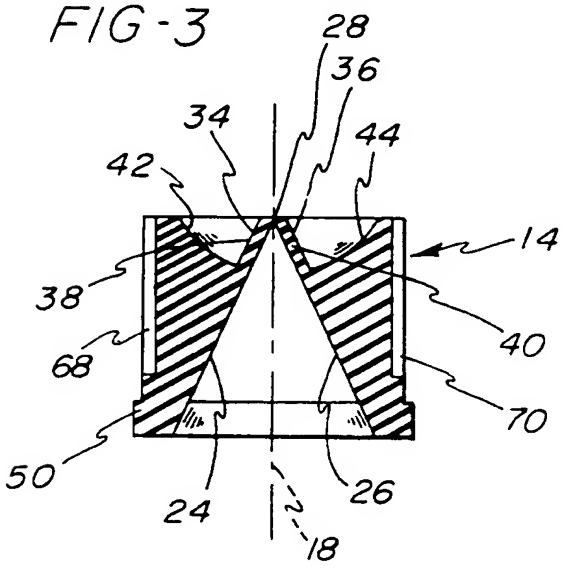
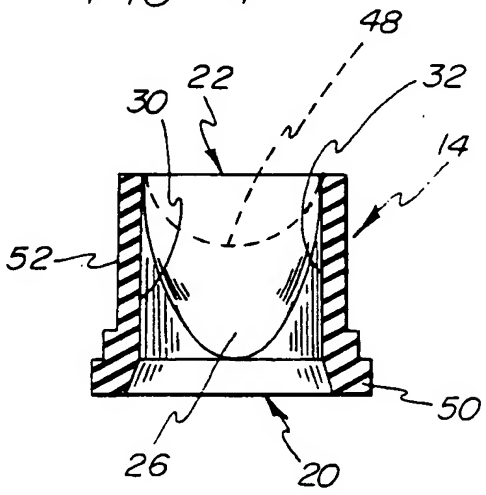


FIG - 4



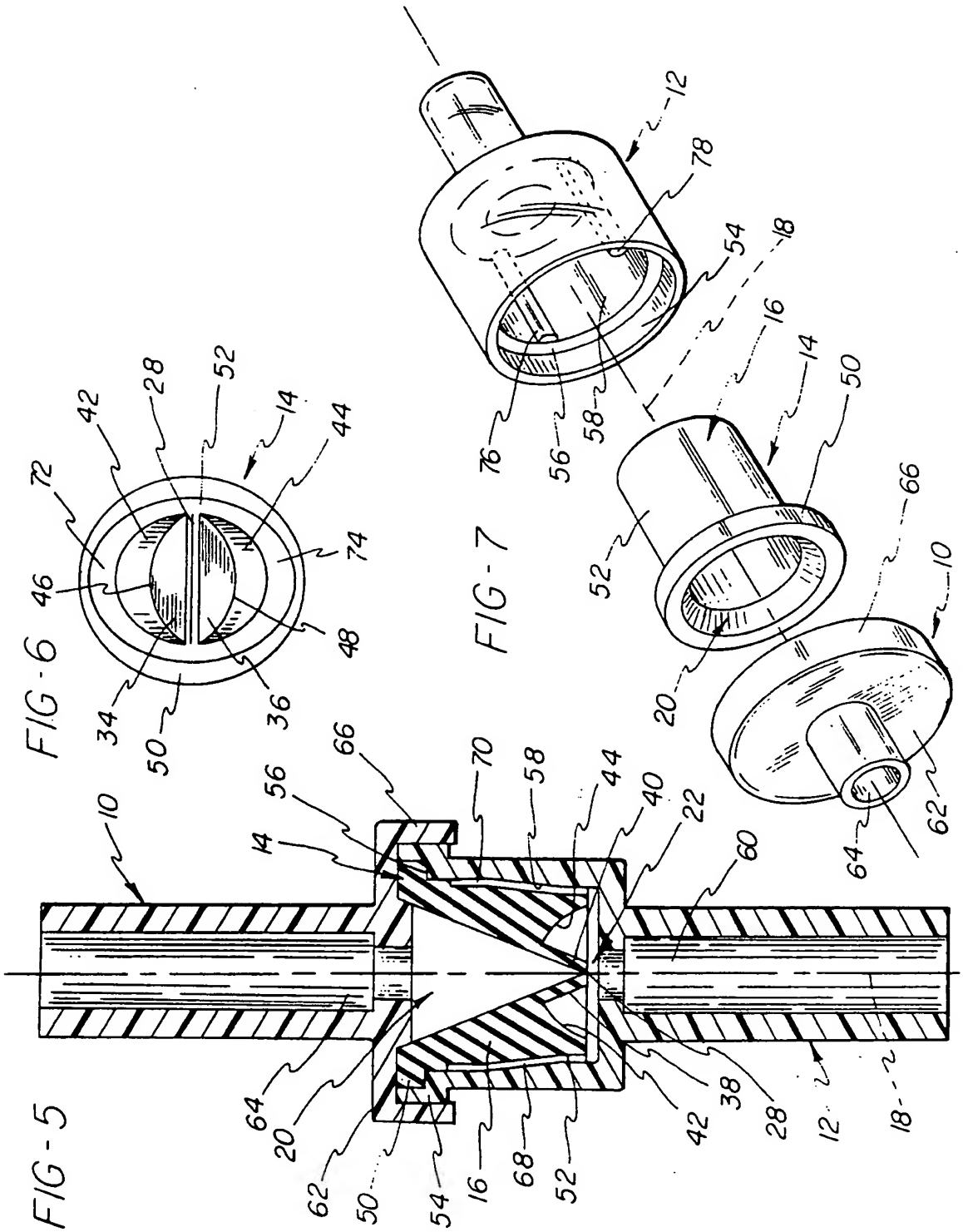


FIG-5
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FIG-6
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FIG-7
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